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THE GENUS ZYGODON IN NORTH AMERICA.

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Three species of *Zygodon* have been listed for the United States and Canada but the genus is omitted from Lesquereux and James Manual, only *Z. Sullivantii* C. M. being included under *Amphoridium.* Macoun's Catalogue (1892) listed *Z. viridissimus* from sterile specimens collected by Drummond at Hudson's Bay. The same year (1892) Dr. Small and I discovered fruiting specimens of a species of *Zygodon* on the summit of White Top, Virginia, which were also published as *Z. viridissimus*[1], but on comparison with Drummond's these specimens proved to be so different that I concluded they must be a different species and sent them to M. Cardot as *Z. conoideus* by which name they are listed[2] from Virginia. I also sent them to Dr. Braithwaite as *Z. conoideus* and he generously supplied me with fine fruiting specimens of this species from Mucross, Killarney. These were compared with ours from Virginia and found to be quite distinct having a well-developed peristome. Unfortunately our specimens had capsules that were either too old or still immature, and it was not till a subsequent visit to White Top that Dr. Small collected abundant material in good condition. This proved that our species had no peristome so I concluded it was a new species and sent it to M. Genl. de Paris as *Z. rufo-tomentosus* ined. and it is so listed in his index in both editions. Nothing further has been published until recently in THE BRYOLOGIST for March (1908) Dr. Grout has listed *Z. conoideus*, *Z. excelsus* and *Z. gracilis*, from the mountains of North Carolina with "determinations doubtful."

We are in much better condition to study our North American species now, since Limpricht's masterly descriptions[3] and Correns'[4] studies on reproduction of sterile mosses by brood-bodies as well as Brotherus'[5] synopsis have appeared. Dixon's[6] remarks will also be found helpful. According to Brotherus, America is the richest in the number of species, leading with 57 of which 53 are endemic. He recognizes *Z. viridissimus*, *Z. Sullivantii* and *Z. conoideus* for the United States and maintains *Z. rupestris* Lindb. as a distinct species, but does not credit it to North America. It is clear to me from recent studies that two of our North American species belong in the first section with those having no peristome and that Drummond's speci-

1 Mem. Torrey Club 4: 180. Pl. 80. 1893.
2 Musci Am. Sept. 26: 1893.
3 Die Laubmoose 2: 10. 1895.
4 Unt. Vermerh. der Laubm. 114. 1899.
5 Nat. Pflanzenfam. fasc. 215. 460. 1902.
6 Handbook 236. 1896.

The May BRYOLOGIST was issued May 1, 1908.

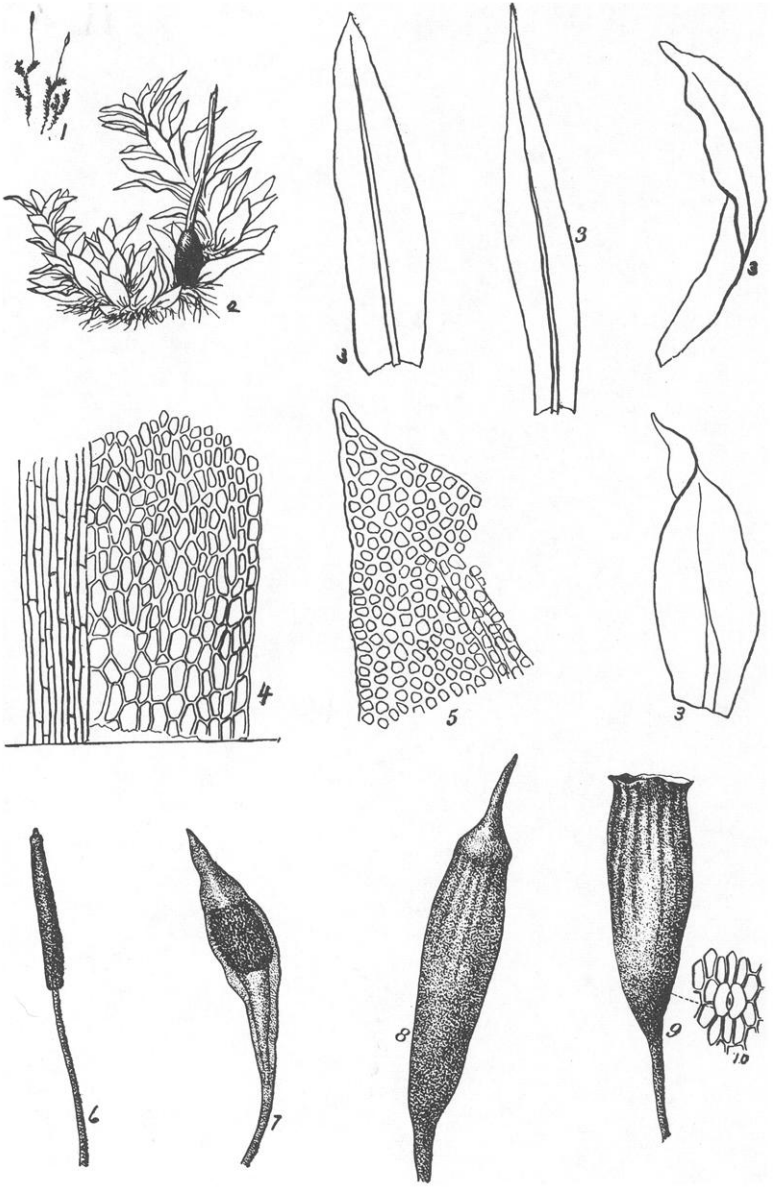


PLATE VI. *Zygodon viridissimus* (Dicks.) R. Br.
Rearranged from Pl. 80 Mem. Torrey Bot. Club, 4: 180, 1893.

mens from Hudson's Bay are referable to *Z. rupestris*. They were so named by Mitten who had a portion of the type. Our Virginia specimens agree with *Z. viridissimus* in habitat as well as structure. It will be found that European authors do not agree as to the specific rank or generic position of these two species nor as to the presence or absence of propagulæ in *Z. conoideus*. Limpricht and Brotherus say they are absent, but Correns figures them for this (Fig. 73) species! Also it will be found that Limpricht, Dixon and Paris Index place *Z. rupestris* as a variety of *Z. viridissimus* whereas Brotherus follows Lindberg and maintains it as a distinct species. We have adopted the latter opinion, not only because our collections are being arranged according to the Engler and Prantl Pflanzenfamilien Synopsis, but also because of the great difference in habitat and range of these two species, as well as other differences in aspect and structure, *Z. rupestris* being a shorter plant, reproducing by numerous propagulæ.

Zygodon Sullivantii has never been found in fruit and its family and genus have always been doubtful. Sullivant first described it as *Syrrhopodon? excelsus*' Müller renamed it as *Zygodon Sullivantii* and the manual has it under *Amphoridium*. Mitten placed it in his herbarium under *Leptodontium* and recent studies have led me to believe that this is its nearest alliance. Its method of propagation by leaves rooting at apex and small deciduous terminal buds and lateral branchlets is well illustrated by Sullivant. It will also be found that Brotherus places *Zygodon Sullivantii* in the group having a double peristome with *Z. gracilis;* its generic position must necessarily remain uncertain until the fruit is found! It will be noted that De Notaris also placed *Zygodon gracilis* in *Leptodontium*. Even the genus *Leptodontium* is variously placed, Mitten including it in the *Dicranaceae* and Brotherus in the *Pottiaceae!*

The following synopsis and descriptions may be of service to those who have not access to the literature cited above:

SYNOPSIS.

Peristome lacking. Tomentum with propagulæ.
- Leaves lanceolate, apiculate, on trees. 1. *Z. viridissimus*.
- Leaves ligulate, lanceolate, on rocks. 2. *Z. rupestris*.

Peristome double. Tomentum without propagulæ.
- Leaves entire. In loose small tufts on trees. (European—*Z. conoideus*.)
- Leaves serrate. On limestone rocks, usually sterile. 3. *Z. gracilis*.

ZYGODON Hook. and Tayl. Musc. Brit. 123. 1818.

Plants pulvinate, light or dark green, on rocks or trees. Stems erect, tomentose with rufous tomentum, branched. Leaves crowded, appressed, secund or twisted when dry, spreading or recurved when moist, lanceolate or linear-lanceolate, apiculate or blunt, entire or serrate at apex; costate nearly to apex, rarely excurrent; cells round, incrassate, smooth or papillose, elongated at base. Dioicous or autoicous rarely heteroicous or polyoicous, often sterile and reproducing by septate propagulæ. Perichaetial leaves only slightly different. Seta exserted, slender. Capsule erect, pyriform or

cylindric, ribbed, mostly small, exannulate; peristome double, single or absent; lid conic or rostrate; calyptra cucullate, smooth or rarely hairy.

Type species *Z. conoideus;* European.

Eleven North American species are known of which eight are Mexican.

1. ZYGODON VIRIDISSIMUS (Dicks.) Brown Trans. Linn. Soc. 12: (1.) 575. 1819.

Bryum viridissimum Dicks. Fasc. Pl. Crypt. 4: 9. Pl. 10. f. 18. 1801.

Plants bright green, 1–2 cm. high. Stems tomentose with papillose radicles often having 4–5-celled propagulæ; branches and leaves secund, 1.5–2.5 mm. long, lanceolate, apiculate; vein ending below the apex, papillose above, smooth below; cells papillose on both sides, upper rounded, thick-walled, lower rectangular and smooth. Perichaetial leaves smaller. Dioicous. Seta 3–5 mm. long, terminal becoming lateral; capsule 1.5–2 mm., pyriform-cylindric, ribbed when old, walls with thickened ridges; mouth red, small; annulus none; peristome none; spores rough, .013–.016 mm., maturing in August; capsules persistent.

Type locality: England.

Distribution: On trees throughout North and Central Europe. Rare in North America; in the mountains of Northern New York and Virginia to North Carolina and Georgia.

Illustrations: Dickson l. c. Pl. 10. f. 18. 1801. Eng. Bot. pl. 1583. 1805. Hook & Tayl. Musc. Brit. Pl. 6, 1818. Br. Eu. 3, Pl 206. 1850. Mem. Torrey Bot. Club pl. 80, 1893.

First collected on White Top, Va., May 29, 1892, by J. K. Small and E. G. Britton, growing on *Picea rubra* with *Dicranum longifolium, Herberta adunca*, etc. Later found at base of trees in the Adirondack Mountains, N. Y., near Adirondack Lodge, Sept. 1892, and Adirondack Reserve, Sept. 1898, forming bright green sterile cushions, mixed with various other mosses.

2. ZYGODON RUPESTRIS Lindb. Milde Bryol. Siles. 164. 1869.

Zygodon viridissimus var. *rupestris* Hartm. Skand. Fl. 9 ed. 52. 1864.

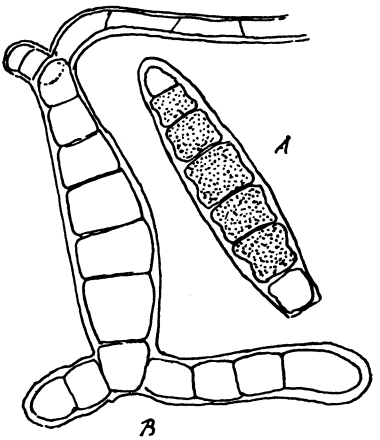
Plants in dense brown cushions matted with radicles at base; stems 1–3 cm. high, bifurcating; branches erect or slightly secund at apex; leaves crowded, slightly circinnate when dry, not recurved but speading when moist, 1–1.5 mm. long, ligulate-lanceolate acuminate, carinate; costa ending below the sharply subulate apex; margins entire; cells round, thick-walled, minutely papillose, basal cells larger, oblong, clear. Dioicous. Fruit unknown! Reproducing by clusters of 3–5-celled brown *propagulæ* borne on radicles in the axils of the leaves.

Type locality: Scandinavia, Lindberg.

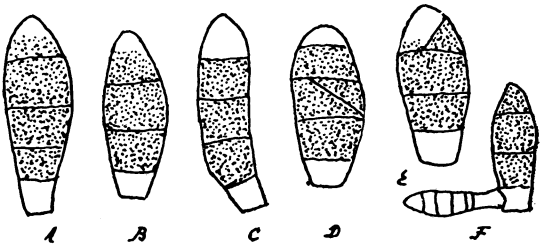
Distribution: On calcareous rocks in mountains of Central and Northern Europe. In America, Hudson's Bay and Vancouver Island. Also on steep cliffs, Cascade Mountains, Washington, J. A. Allen.

Exsiccatae: Drummond, North American Mosses No. 27. 1828. Allen's Mosses of the Cascade Mountains No. 46. 1898.

Illustrations: The gemmæ correspond with those figured by Correns Unt. 117. f. 71 for *Z. viridissimus f. borealis!*



CORRENS FIG. 73.



CORRENS FIG. 71.

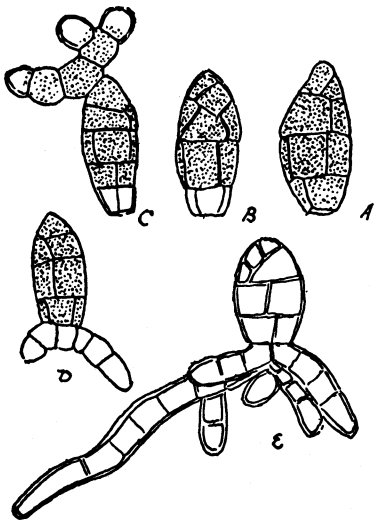
FIG. 69, p. 115, Correns.

Zygodon viridissimus the genuine form from the South and East. A. B. brood-bodies. C. germinating stage from the detritus. D-E. germinating stage from a culture × 280.

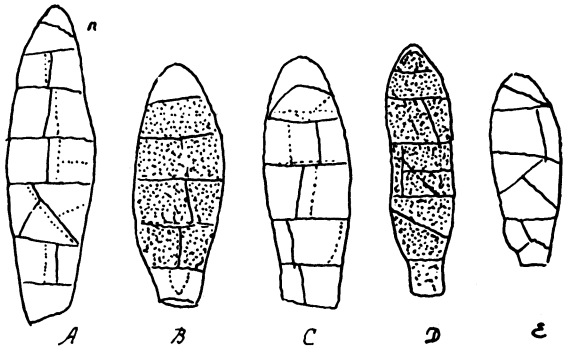
Material from Allgäu, 1895. Dr. Haller.

Zygodon viridissimus forma *australis* Correns.

In this form the brood-bodies are numerous and almost all sprouted, as in all the species of *Zygodon* which have been investigated, being borne on much branched rhizoids which are clustered in the axils of the leaves. The brood-bodies are shorter and less divided than in figure 70, the form which Correns calls *Zygodon viridissimus* f. *australis* occid. from the Voges and Departments of Lot and Garonne, France. The Northern form which ours most resemble, Fig. 71, which Correns calls *Zygodon viridissimus* (genuinus) f. *borealis* Correns came from Neuruppin, Germany, and has 4–6 septate brood-bodies which are much simpler than the Southern forms. Thus far this is the only form we have found in America, as our specimens all came from elevations varying from 2200 to 5000 feet and are distinctly boreal in distribution.



CORRENS FIG. 69.



CORRENS FIG. 70.

3. ZYGODON GRACILIS Wils. Berk. Handb. Brit. Mosses 219, 1863.
Leptodontium gracile De Not. Cronaca, 1868.
Amphoridium gracile De Not. Epil. 278. 1869.
Trichostomum gracile Mol. Bay, Laubm. 79. 1875.
Zygodon Nowellii Sch. Syn. 297. 1876.
Didymodon subalpinus Card. Rev. Bryol. **14**: 21. 1887.

Plants in dark green dense cushions on rocks, 2–7 cm. high; stems branched and matted with brown tomentum, stout or slender when pendent; leaves crowded or distant on young branches, spirally twisted when old, spreading or recurved when moist, lanceolate, 2–2.5 mm. long, carinate; costa stout, ending below the mucronate apex, papillose on back; margins sharply serrate above, entire below, long decurrent at base; cells densely papillose, alar rectangular, clear and smooth. "Dioicous. Perichaetial leaves not differentiated. Seta 8 mm. long, exserted; capsule erect, cylindric, striped and plicate when dry, with a narrow mouth; lid apiculate; annulus very broad, persistent; peristome double; teeth united in pairs, cilia 8, of 2 rows of papillose cells; spores .012–.014 mm. smooth. Ripe in August."[1] Quoted from Limpricht; fruit not seen!

Easily distinguished from *Barbula reflexa* for which it is liable to be mistaken, by its sharply serrate leaves.

Type locality: Yorkshire, England. Nowell, 1856.

Distribution; England and Ireland rare! Fruit scarce. Also in Switzerland, Bavaria and the Tyrol. First discovered in America by Dr. A. J. Grout in great abundance on the faces of cliffs on Chestnut Bald, North Carolina, 6000 ft. elevation. Aug. 1907.

Exsiccatae: Wilson Musci Brit. No. 200, 1862, and Holzinger Musci Acrocarpi Boreali-Americani.

Illustrations; Limpricht Laubmoose 2: fig. 214. 1895.

1. Limpricht Laubmoose **2**: 14. 1895.

LEPTODONTIUM Hpe. Linn. 20: 70, 1847.

Plants in loose, weak, yellowish-green tufts. Stems tomentose or scarcely radiculose, branched or bifurcating. Leaves not crowded, spreading or curled when dry, recurved when moist, keeled, lanceolate; base elliptic or ovate; margins entire and recurved below, irregularly serrate above; costa pecurrent or ending below the apex; cells elongated rectangular at base, rounded, hexagonal above, minutely papillose on both sides. Dioicous, often sterile and propagating by buds or brittle branches. Seta erect, single or several from the long sheathing perichaetium; capsule erect, cylindric, smooth; annulus double; peristome arising below the mouth, without basal membrane; teeth smooth, nodose, bifid or split; lid conic or rostrate; calyptra?

Fifty-seven species of which 37 are American, of which 5 occur in Mexico. First record for North America of this genus.

Type species *L. squarrosum* from India and Africa.

Leptodontium excelsus (Sull.) E. G. Britton, comb. nov.

Syrrhopodon? excelsus Sull. Musci All. 41. 1848.

Zygodon Sullivantii C. M. Syn. 1: 679, 1849.

Amphoridium Sullivantii L. & J. Man. 159. 1884.

Zygodon excelsus E. G. Britton Mem. Torrey Bot. Club. 4: 180. 1893, not C. M. Linn. 42: 369, 1878.

Plants slender, erect or pendent; stems dark-colored, simple or branched, 4–10 cm. long, with filiform innovations; leaves distant, light yellow at apex of stems, curled and twisted when dry, spreading when moist, 1.5–2 mm. long carinate, lanceolate-acuminate, decurrent at base; margins entire and recurved below, serrate above; vein smooth, not keeled, ending in a subulate point, often radiculose at apex; cells thickened, minutely papillose, basal elongated, oblong and smooth, generally yellow. Flowers and fruit unknown! Propagating by rooting at the apex of the leaves or by brittle branchlets.

Type locality: Grandfather Mountain, North Carolina, Sullivant.

Distribution: On rocks and twigs on the summits of Grandfather, Chestnut Bald and Black Mountains, North Carolina. Also on spruce trees, White Top, Virginia, and mountains of Georgia, Lesquereux, 1850. Paris Index 1: 32. 1903, cites *Amphoridium Sullivantii* from "Prom. Breton." We know of no record of this species except from the Southern Alleghanies.

Exsiccatae: Sull. Musci All. 170. 1848. Sull. & Lesqx. Musci Bor. Am. No. 114. 1856. No. 169. 1865.

Illustrations: Sull. Icones Muscorum 1: 51 t, 32. 1864.

The illustrations of the winged costa, Sullivant's Icones Pl. 32, f. 13, appears to be incorrect. Mitten placed this species in his herbarium with *L. brevisetum* from Mexico, but it differs from our plant in being stouter with more squarrose leaves and different cell structure, etc.

New York Botanical Garden.